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ABSTRACT

This paper discusses various educational strategies for interactive videodisc design that were derived through scanning, synthesizing, and simplifying implications from a wide variety of learning theories. Four initial assumptions about videodisc technology are presented: (1) videodisc systems are more likely to be effective if learning theories inform their design; (2) application of videodisc systems should not be limited to lower levels of behavior or cognitive functioning; (3) the capabilities of interaction (control, feedback, pace) inherent in videodisc microcomputer technology can expand access and multiply the flexible use of visual materials; and (4) combinations of videodisc and microcomputer technologies may give rise to additional instrumentation of learning theory research. Five unique features of the videodisc are also identified and briefly discussed. The major part of the paper focuses on three learning theories--behavioral, cognitive, and humanistic--and videodisc applications for each. It is suggested that educators should continue to evaluate the implications, assets and limitations, and best instructional uses for the videodisc and recognize that this medium can also provide instrumentation for research, particularly on higher order cognitive learning and critical reflectivity. A chart displaying the three learning modes, theoretical traditions, major learning theorists, associated concepts, and potential videodisc utility is provided, as well as a list of references. (JB)

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Educational Strategies for Interactive Videodisc Design

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Purpose

The purpose of this paper is to present a list of educational strategies which were derived through scanning, synthesizing, and simplyfying implications from a wide variety of learning theories and making practical suggestions for interactive videodisc design. The list is not exhaustive, but merely suggestive of the many alternative ways to hypothesize and to structure interactive video activities based on assumptions about learning in behavioristic, cognitive, and humanistic learning traditions.

In this paper, we make the following assumptions:

1) Videodisc systems are most likely to be effective if learning theories inform their design.

2) Application of videodisc systems should not be limited to lower levels of behavioral or cognitive functioning. The visual and symbolic capabilities of videodisc make it possible to enhance more complex levels of cognitive learning as well as to aid learners in criticism of psychological, political, or social phenomena, and in reflection on their personal attitudes, values and aspirations.

3) The capabilities of interaction (control, feedback, pace) provide additional features to the traditional use of visuals in education. The list of educational strategies provided in this paper is not new to educators who have emphasized learning through visualization. However, videodisc microcomputer technologies can expand access and multiply the flexible use of visual material.

4) Combinations of videodisc and microcomputer technologies may give rise to additional instrumentation of learning theory research since a broad range of behavioral, cognitive and affective operations can be advantageously designed and tested together.

Promise of Videodisc

It has long been recognized that visualization is an important part of learning. What is unique about interactive video systems is the capability to link various modes of presentation for

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learners and to have many ways of accessing knowledge. Coupled with the capacity of computers to represent and manipulate graphics, the combination of realistic and graphic images represents an unprecedented opportunity for the learner to bring these together. Students are able to access video images, graphics, and text, and use these representations of material to clarify understanding (Salomon, 1979).

Most computer-based learning programs are predominantly oriented to words and text. Graphic and visual representations greatly enhance instruction about spacial relationships, and about objects or procedures that can be visually depicted, or for modeling. Graphics and visual representations of material, used separately or in conjunction with one another, provide a powerful medium in which to illustrate knowledge or processes or from which concepts and judgments can be derived. Furthermore, we believe that dynamic graphics and video motion sequences allow the interactive video system to demonstrate changes, processes and procedures in a way that few other media can.

Interactive videodisc combines powers of the microcomputer with the image and audio storage capabilities of the optical laser disc. One side of a videodisc can hold 10 billion bits of information, which is equivalent to 54,000 video still frames or 30 minutes of motion per side. Any single frame can be retrieved in 1 - 2 seconds. This technology has the ability to overlay computer-generated text or graphics upon a video image, which gives it highlighting and explaining potential absent in ordinary television or non-interactive videodisc.

Features of interactive videodisc systems include automatic frame recall and stop; dual audio tracks, adjustable forward and reverse; and speed control, as well as the capability to freeze a frame. Learners can interact with the system by touching the screen, typing answers or choices on a keyboard, using a light pen, or through voice recognition and speech synthesis. The most important feature of this technology is its ability to mix digital, analog, audio (up to 75 hours of compressed audio per side), film, and photographic presentations in any conceivable combination---a situation unattainable in the past.

Some of the unique characteristics of videodisc that make it a promising medium for teaching are as follows:

1) Interactive videodisc systems provide for forms of presentation (i.e. rich visuals and audio sequences, graphics and overlay graphics)
(Bunderson, 1980).

2) Interaction is a major strength of a videodisc system. Interactive discovery or inquiry approach which requires participation and user control enhances learning, problem-solving, and decision making skills. Learners can control their own learning sequence, content, forms of representation, speed of presentation (slow motion, fast motion, or still frames), and overall pace (Bruner (1966): Merrill, 1979).

3) Interactive videodisc can provide immediate and appropriate feedback and reinforcement because material can be presented according to the needs and ability level of individual learners. The management and record-keeping capabilities of the system allow for cumulative records to

be kept, which allows for individualization to occur (O'Shea and Self, 1983).

4) Because of its vast storage capacity, videodisc systems provide multiple ways of accessing information including opportunities for realistic practice, multiple examples, problems, exhibits, etc. (Bunderson, 1981).

5) The videodisc can add interest, enthusiasm, and motivation due to the intrinsic appeal of visual images, simulations, feedback, individualized instruction, and games (Malone, 1981).

Some Educational Strategies Drawn From Scanning Selected Learning Theories

Instead of beginning with the tradition of computer-assisted instruction (CAI) and projecting possible advantages of videodisc to enhance CAI, we decided to scan the broad range of learning theories for potential expanded uses of videodisc. The research literature on learning theory is quite diverse and complex, arising from several streams of modern psychology. The behavioral and neo-behavioral psychologists draw upon the work of Pavlov, Watson, Thorndike, Hull, Skinner, Gilbert and Gagne, to name a few of the better-known researchers. Their theories focus on learning as conditioning, shaping, reinforcing, modeling, or chaining. The cognitive/ developmental/ gestalt psychologists, on the other hand, draw upon the work of Tolman, Wertheimer, Lewin, Piaget, Ausubel, Bruner and Landa to, name a few. Their theories tend to focus on comprehending, conceptualizing, perceiving, mapping and achieving levels of cognitive operations. A third stream of educators can be described as humanistic/philosophic. This group of researchers and theorists draws upon the work of Maslow, Rogers, Freire, Habermas, and Mezirow to name a few. Educators drawing from this tradition are likely to focus on the meaning of experience, communicative action, dialogue, reflection, self-knowledge, critical awareness, values, feelings, attitudes, aspirations, choices, and perspective transformations.

As a result of scanning theorists, our conclusion is that each of these steams of learning theory, is directed toward different yet complimentary objectives and that visual operations, including the features of videodisc, serve different functions for each stream of theorists. The following summary will illustrate this thesis.

Behavioral/ Neo-Behavioral Tradition and Videodisc Utility

Visual imagery within the behavioral tradition is important, particularly for modeling and demonstrating. The visual environment can be viewed as a means toward shaping. Although the earlier developments of programmed instruction that formed much of the basis of CAI did not make significant use of visual images, the use of videodisc now has the potential to enhance this tradition, particularly for psychomotor learning. The use of visual images and audio sound tracks on videodisc for reinforcement is also not to be overlooked. Videodisc now makes possible very complex games and simulations that can provide learners with immediate visual feedback that results from their psychomotor choices and operations. Flight simulators for the training of airline pilots and astronauts are examples.

With the aid of videodisc, a learner may conveniently:

a) Scan a new behavioral environment .
b) Observe and review demonstrations, procedures, or operations.
c) Visualize desired behaviors or performance standards.
d) Visualize physical sets prior to guided responses.
e) Execute procedures and operations through guided responses, games, and simulations.
f) Receive audio and visual feedback and reinforcement from performance choices and operations.

Cognitive/Developmental/Gestalt Traditions and Videodisc Utility

This tradition, although not ignoring the contributions of the behaviorists, has emphasized cognitive functioning within the "black box." Expository or reception learning is emphasized by Ausubel (1968) while Bruner, building from Piaget (1965) emphasizes discovery learning. Discovery learning can be an adaptive/diagnostic or guided inquiry process as well as a free exploratory activity. Landa (1974), on the other hand, suggests that cognitive learning requires discovery as well as the recognition and application of algorithms, rules and heuristic devices to cases or examples. Gestalt psychologists have pointed out the important relationships between parts and wholes and the need for cognitive closure. For reception or expository learning, visual images are typically used to: illustrate, diagram, or map; provide examples of facts, concepts, or principles; apply rules; or to test comprehension. For discovery learning, visual images have a very different function. Pictures typically are the initial means by which learners inductively explore and extrapolate for themselves the answers to their curiosity, reasoning and testing from the particular to the general. Videodisc systems have the potential capacity to enhance the design of both expository and discovery-learning strategies. It is possible to provide learners with immediate access to an abundant choice of visual material for both illustrative purposes or for inductive analysis. The range of visual material can include: photos of whole collections of scientific specimens; historical and anthropological evidence; maps and places; film or video tape of natural processes, disasters and accidents, interpersonal interaction; and historical events. The engineering videodisc lesson on why the Tacoma Bridge collapsed is a good example of guided discovery learning (Fuller, Zollman and Campbell, 1982).

With the aid of videodisc, learners may conveniently:

a) Memorize and practice recall in response to visual cues or symbols.
b) Apply concepts, principles and procedures to visual examples.
c) Classify visual presentations according to categories.
d) Compare symbols with realistic representations for validation.
e) Identify appropriate application of rules, algorithyms, and heuristic devices to cases.
f) Diagnose problem areas of performance, malfunction or illness, and propose remedies.
g) Choose hypothetical decisions or make changes in procedures and observe results.
h) Observe parts and identify them in relationship to wholes.
i) Observe wholes and identify essential or characteristic features of parts.

j) Observe and discover alternative forms of objects or events.
k) Compare changes to objects or environments that take place over time.
l) Draw symbolic representations or concept maps from realistic images.
m) Analyze, process, aggregate, and summarize visual data.
n) Analyze examples to formulate definitions, rules, principles, and concepts.
o) Describe, explain, and interpret interactive cause and effect relationships in events
p) Identify limitations for and constraints to observed functions or operations

Humanistic/Philosophic Tradition and Videodisc Utility

Habermas (1971) differentiates between three generic domains of learning or learning modes, the instrumental/practical, the social/communicative, and the emancipatory/self-reflective. The humanistic/ philosophic traditions of learning have focused on the latter two of these domains, while the behaviorists and the cognitive/developmental psychologists have tended to focus upon the instrumental domain. According to Habermas, it is a mistake to assume that the mode of inquiry derived from the instrumental domain is equally appropriate for all three domains. The social/communicative domain requires reflection and interpretation of one's experience related to one's culture and society, and includes inquiry into descriptive social science, history, religion, aesthetics, law and anthropology. The emancipatory/self-reflective domain requires examination of one's identity, reifications, childhood dilemmas, habits of perception, cultural assumptions and governing rules, roles, conventions and social expectations which dictate the way we see, think, feel and act. Mezirow (1981) has called this process "perspective transformation" and asserts that it is the essence of adult critical awareness. Freire (1970) describes this process as conscientization, a form of social consciousness raising that liberates and leads to praxis. Humanistic psychologists, following in the tradition of Maslow (1954) and Rogers (1969), also have emphasized reflection on emotions, attitudes values, aspirations, self esteem, and self-awareness through human interaction as an essential domain for learning. What all of these humanistic/philosopical theorists have in common is a focus on the importance of one's capacity to reflect on one's psychological, cultural, political and social experience as it has meaning for the self.

Educators in the humanities including religion have long appreciated the importance of visual objects and events (visual arts, architecture, cultural artifacts, and symbolic acts) as the catalyst for critical awareness learning. While dialogue is the central mode for concensual validation, visual imagery can provide the focus for intrapersonal, as well as interpersonal, dialogue. Videodisc systems now enable learners to access and reflect on a broad range of visual objects and events that can provide the focus for social/communicative and emancipatory/self reflective learning.

With the aid of videodisc, the learner may conveniently:

a) Orient oneself to new environments or cultural situations.
b) Analyze and compare objects and events from different cultures.
c) Appreciate and critique presentations of the visual arts.
d) Experience vicarious symbolic action and reflect on its personal meaning.

e) Evaluate and judge relative qualities and values in visual objects or events.
f) Identify and question cultural assumptions underlying social behavior.
g) Reflect on evidence of social contradictions and propose alternative actions.
h) Validate or test hypotheses, myths, and reifications against visual data.
i) Explore and clarify commitments to personal values.
j) Question and analyze the validity of moral decisions.
k) Explore and expand personal aspirations and goals.
l) Recognize emotions in visual situations and define personal feelings.
m) Observe visual images to stimulate creative self-expression or visions of the future.

Summary

We believe that intelligent videodisc systems provide an especially promising resource for addressing higher order learning within the cognitive/developmental/gestalt psychological tradition. Videodisc systems can provide the opportunity to present cases or problems which involve learners in the manipulation, analysis of information, synthesis, or evaluation levels, rather than merely requiring drill and practice responses at the comprehension level. In addition, we believe that the visual and audio storage and retrieval capacity of videodisc systems also can expand the instructional design and dialogue possibilities for educators within the tradition of the humanistic psychologists and humanities educators through the use of learner operations suggested in this paper.

It is imperative that educators continue to evaluate the implications, assets and limitations, and best instructional applications for this new media. We also recognize that videodisc can provide instrumentation for research, particularly on higher order cognitive learning and critical reflectivity.

A map displaying the three learning modes, theoretical traditions, major learning theorists, associated concepts and potential videodisc utility is presented below in Figure 1.

FIGURE 1: SUMMARY OF LEARNING THEORIES AND POTENTIAL VIDEODISC UTILITY

LEARNING MODES	TRADITIONS	THEORISTS	CONCEPTS	VIDEODISC UTILITY
Instrumental	Behaviorist	Pevlov Watson Thorndike Hull Skinner Gilbert	Association Conditioning Shaping Modeling Reinforcing Chaining	Demonstration Feedback Practice
	Neo-Behaviorist	Gagne	Processes Levels	Simulation
	Cognitive/ Developmental/ Gestalt	Tolman Wertheimer Lewin Piaget Ausubel Bruner	Comprehending Conceptualizing Perception Stages Exposition Discovery	Visual recall Visual examples Diagnosis Records of change Result observation Object/events-data Image extrapolation
		Landa	Algorithyms	Application of rules Rules extrapolation Inferential analysis
Social/ Communicative	Humanistic/ Philosophic	Freire Habermas	Conscientization Critical- reflectivity	Cultural comparison Ethical evaluation Artistic criticism Aesthetic appreciation Role exploration
Emancipatory/ Self-Reflective		Maslow Rogers	Self-actualization Self-understanding	Creativity stimulation Emotional recognition
		Mezirow	Perspective- transformation	Values comparison Symbolic participation

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